

CALIFORNIA ENERGY COMMISSION1516 NINTH STREET
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July 10, 2002

Charles C. Cottrell
Director, Technical Services
North American Insulation Manufacturers Association
44 Canal Center Plaza, Suite 310
Alexandria, VA 22314

Dear Mr. Cottrell,

Thank you for your letter dated May 22, 2002 and our ongoing phone conversations, most recently on June 13, 2002. We very much appreciate NAIMA's interest in the 2005 Standards proceeding. By working together we believe we can establish standards that are very effective. We are at an early stage in the process and look forward to further discussion with NAIMA and refinement of Commission proposed approaches. The next step will be for us to develop draft standards. Then we plan to hold workshops to receive public comments on the draft standards this fall. We will then refine the draft standards to respond to comment. Finally, next spring we will conduct a formal rulemaking proceeding for final public comment and potential revisions, with adoption targeted for July, 2003.

Thank you for listing your concerns. We appreciate the opportunity to address them and provide clarification about our thinking. We highlight some of your key comments below and provide a response.

One comment NAIMA made is,

All building materials and systems can be installed improperly and all building codes can languish unenforced. To assume anything less than the design efficiency of a proper installation is simply the wrong approach.

California's building standards are fundamentally performance standards. This makes them unique compared to those adopted by other states. Although other codes may have a performance option, it is relatively unused. In California over 80% of residential buildings use the performance standards. The performance approach is based on computer modeling to calculate an energy budget for the building (termed the Standard Design) and the expected energy use of the proposed complying building (termed the Proposed Design). We have a long history of making the performance standards an effective and reliable way to achieve the energy savings expected by our Standards. We are required by statute to maintain the performance standards computer program and establish compliance options for new technologies. As part of that process, we scrutinize the energy savings claims of measures, and establish conservative modeling assumptions and eligibility criteria. We set compliance credits at the minimum that is reasonably expected to be achieved.

In the mid-1990s the Commission became increasingly aware of a substantial problem that jeopardizes the reliability of Standards savings. Research in California has shown that defects in the installation of energy efficiency measures can result in substantially lower energy savings than would otherwise be expected. Our first exposure to this was duct leakage. We developed a method to combat this problem by creating an incentive within the performance standards for quality construction and installation of measures. We assume for the performance standards (Standard Design) a default level of installation quality that corresponds to observed levels of quality installation in the field without the special efforts associated with a targeted quality control program. We establish a performance standards credit for quality construction by comparing to this Standard Design level.

The Commission has used this approach to establish compliance credit for quality construction for a variety of duct improvements (including duct sealing, duct design, duct location, and duct surface area), reduced building envelope leakage, and improved air conditioner installation (including proper refrigerant charge and airflow and installation of thermostatic expansion valves (TXVs)). This quality construction approach has become a very important part of our Standards program. We have a special chapter in our *Residential Energy Conservation Manual*, titled “Compliance Through Quality Construction” that explains the Commission’s emphasis on this approach (http://www.energy.ca.gov/title24/residential_manual/res_manual_chapter4.PDF). The approach has established a means within the Standards to provide incentives for a focused effort on quality construction. It also has been used by the utilities to provide financial incentives and focused training for contractors for improved installation techniques and diagnostic methods to insure quality construction. The approach is a fundamental feature of California’s *Energy Star* program for new homes, which is run in cooperation with all of the major California utilities.

This quality construction approach is widely supported by the major stakeholders in California, including the California Building Industry Association (CBIA), the Natural Resources Defense Council (NRDC), and the California utilities. Up to this point the NAIMA representative has strongly supported the establishment of the construction quality approach and the application of it at each step of the way as we applied it to ducts, building envelope sealing and air conditioner installation.

The Commission recognized several years ago that there is a need to address the quality of construction of building envelopes in California – in particular the installation of insulation and the construction of an air barrier that is continuous and contiguous with the thermal barrier formed by insulation. In collaboration with the California Institute for Energy Efficiency (CIEE), Lawrence Berkeley National Laboratory (LBNL), California Association of Building Energy Consultants (CABEC), Building Industry Institute (BII – the research and training arm of CBIA), and NRDC, a project was conducted to assess the potential for improving the construction of building envelopes in California new construction. A report, *Protocols for Energy Efficient Residential Building Envelopes*, was completed in January 1999. The protocols have been posted on the Commission’s Quality Homes website (<http://www.energy.ca.gov/efficiency/qualityhomes/index.html>) since that time. They also have been used by BII in its Building Energy Codes training program of California’s largest production builders, funded by DOE’s Exemplary and Progressive Building Codes program. The report recommended that Standards compliance credit be developed for third party verified construction quality improvements of building envelopes.

Another statement in NAIMA's letter was,

Simply put, relying on information from only ten homes as the basis of determining the cost-effectiveness of wall insulation is both technically inappropriate and legally unsupportable. Such dramatic changes in the energy code as contemplated by the CEC should be based on a significant sample size and rigorous statistics, not on the mere anecdotes presented to date.

The field research to which you refer was a study done for the Commission by the Davis Energy Group (DEG) with Rick Chitwood serving as principal investigator. The research found strong evidence for the existence of construction defects in the typical construction of building envelopes in new California residences by making field visits to 60 new homes. The principal investigator took extensive photos and IR camera video of examples of improperly installed insulation and other defects in the building envelope in many of these homes. A detailed assessment was made of the extent of defects in insulation in ten homes (including homes that were subject to a focused industry quality control program for insulation installation and homes that were not part of such a program). The homes in the detailed assessment that were not part of a focused quality control program were representative of the rest of the 60 homes that were inspected as part of the project. Mr. Chitwood has extensive experience as a construction quality teacher, inspector and installer. He has observed the level of insulation installation quality in a large number of new California homes beyond the 60 that were inspected in this study. He views the level of installation quality, determined by the detailed assessment for the homes which were not part of a focused quality control program, to be representative of common California construction practice.

As part of the BII Building Energy Codes Training Program, on-site surveys are conducted to evaluate the extent of problems in the installation of insulation and other aspects of the building envelope. In the *Protocols for Energy Efficient Building Envelopes* report, levels of defects in various aspects of installation of insulation were reported based on the on-site surveys. The adjustments to overall U-factors of building envelope assemblies reported in the "Protocols" report are similar to those found by the DEG/Chitwood research.

Oak Ridge National Laboratory (ORNL) also has conducted research on the extent of reductions in the effectiveness of insulation due to commonly observed installation defects. This research has been reported in the proceedings for the *Thermal Performance of Exterior Envelopes in Buildings VII* conference (ASHRAE, December 1998), and in *Energy Design Update* (September 1999), and *Home Energy Magazine* (November/December 1999). The levels of reduced effectiveness of commonly observed insulation installation defects reported by ORNL is similar to that found by the DEG/Chitwood research.

About half of the reduction in the effective U-factor, reported by DEG/Chitwood for wall insulation installed between framing members, arises not because of observed installation defects but because of recent research on the extent of framing in California residences. The American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) has since the mid-1990s advocated in their Handbook of Fundamentals the use of higher framing percentages than has been used in Title 24. ASHRAE recently completed field research further investigating framing percentages, which confirmed their recommended levels.

Through its Public Interest Energy Research (PIER) program, the Commission sponsored a special parallel study of framing percentages in California homes and reported study results in *Characterization of Framing Factors for Low-Rise Residential Building Envelopes in California*, November 2001. The DEG/Chitwood research includes framing factors consistent with those found in the ASHRAE and Energy Commission research in its determination of effective U-factors for “as installed” insulation.

The Commission is not aware of other studies of the extent of defects in the installation of insulation in new homes, either in California or elsewhere. If NAIMA is aware of such studies and could make them available to the Commission, that would be helpful. The Commission recognizes that the industry is keenly interested in improving the quality of installation. This is reflected in several installer training and certification and quality control programs operated by different portions of the industry aiming for installation excellence. Also, the Commission appreciates NAIMA’s active involvement in production of videos related to correction of common installation defects. The Commission views the establishment of a compliance credit for quality installation of insulation as an opportunity to work closely with the industry on a common objective.

NAIMA’s letter also stated,

NAIMA strongly objects to the CEC presenting this information that depicts anecdotal problems with only one insulation material. The pictures in this presentation and the information in the report improperly imply that one type of insulation is trouble-free and another is wrought with problems.

The Commission staff agree that any insulation type can be improperly installed, resulting in defects and reduced effectiveness and that any type of insulation can with attention to detail be very effectively installed. In fact the videos that the Commission produced in collaboration with NAIMA show beautifully installed batt insulation.

Whether the wall insulation is fiberglass batts installed between framing members or sprayed cellulose, problems can occur. We agree with NAIMA that the Commission should not assume a priori that one insulation type is prone to defects and another is not. We think that construction quality compliance credit should be awarded for any wall insulation type only after verification that potential defects do not exist. We would like to work with NAIMA to develop workable verification methods to check to make sure that the installation, regardless of insulation type, is truly high quality.

We would like to acknowledge your willingness to work with the Commission on improved quality construction for insulation and other aspects of the building envelope. We think that establishing compliance options that provide incentives for high quality building envelopes will create market opportunities for installers who are prepared to provide these services. Reduction in the extent of construction defects should have the same benefit to the insulation industry that the California building industry sees, namely reduced callbacks and exposure to liability.

We would like to work cooperatively with NAIMA to establish appropriate U-factor adjustments to address common defects, and establish appropriate checking protocols to verify quality construction. We anticipate that there will be strong interest by CBIA and the utilities to jointly sponsor training for installers to effectively implement the approaches adopted in the Standards.

Thank you again for your letter. I look forward to working with you.

Sincerely,

Original signed by Bill Pennington

G. WILLIAM PENNINGTON
2005 Building Energy Efficiency Standards Project Manager